DATA SHEET

BOVIAR

DIAGNOSTIC SYSTEMS

FLAT JACK TESTING EQUIPMENT

FLAT JACK TESTING EQUIPMENT

WHAT DOES IT DO

Estimation of in-situ compressive stress within solid unit masonry (single-jack testing) and In situ measurement of masonry deformability properties (double-jack testing).
Monitoring of stress changes in elements such as concrete lining of pre-existing tunnels.

ADVANTAGES

- Compact and easy to carry;
- Simple to install and use;
- Reliable and accurate;
- Compliant with **RILEM** recommendations.

DESCRIPTION

Device for applying the load, consisting of welded metal pockets, pressurized by means of a measuring fluid.
Equipped with a fluid inlet and outlet system.

APPLICATION

SINGLE-JACK TESTING:
The determination of the state of stress is based on the stress release caused by a plane cut perpendicular to the wall surface. The stress release is determined by a partial closing of the slot (this means that the distance between the gauge points previously fixed to the wall across the slot will be shorter than before the cutting).

A thin flat-jack is placed inside the cut and the pressure is gradually increased to obtain the distance measured before the cut. The pressure of the hydraulic system driving the displacement equal to those read before the slot, will give the stress condition in that area, after taking in due consideration some correction factors. The displacement caused by the slot and the ones subsequently induced by the loaded flat jack are measured by a removable strain gauge before and after the slot and during the tests.
In brickwork, the cut can be easily made in the horizontal joints and in this case rectangular flat jacks can be normally used. Differently, with stonework made with irregular stones flat-jack testing is less easy, due to the lack of regular joints: in this case the cut for the insertion of the jack is made directly in the stone courses by using a suitable cutter fitted with a steel blade with a diamond cutting edge and the jack will have the same shape as the cut.

Figure 1 - Flat jack testing equipment.

Figure 2 - Double-jack testing.

SEDE CASORIA (NA)

Via G. Puccini, 12/A
80026 - Casoria (NA)
Tel.:(+39)081.758.35.66
Fax.:(+39)081.758.78.57
info@boviar.com

SEDE GERENZANO (VA)

Via G. Falcone, 41
21040 - Gerenzano (VA)
Tel.:(+39) 02.937.99.240
Fax.:(+39) 02.933.01.029
info@boviar.com

BOVIAR

DOUBLE-JACK TESTING:

The flat-jack test can also be applied to determine the deformability characteristics of a masonry. In this case a further cut is made, parallel to the first one, and a second jack is inserted, at a distance of about 50 cm from the other.
The two jacks delimit a masonry sample of appreciable size to which a uniaxial compression stress can be applied. Measurement bases for removable strain gauge on the sample face provide information on vertical and lateral displacements. In this way a compression test is carried out on an undisturbed sample of enough large area.
Loading cycles can be performed at increasing stress levels in order to determine the deformability modulus of the masonry in its loading and unloading phases.

THE TOP OF THE INSTRUMENTATION FOR THESE TESTS:

The reliability in determining the value of the stress state is the fundamental requirement required of the testing technicians by the designers and although the test with flat jacks is relatively simple, the magnitude of the error (function of various factors) of the data detected can become substantial up to invalidate the same results.
Further to the experience built up along with our customers over 30 years of supplies (more than ten thousands flat jacks sold), various experimentations with University Laboratories and Research Centres and full involvement in demanding projects (such as the consolidation works of the columns in **Cathedral of Pavia**, just to quote one), our company has selected the most suitable equipment to carry out this kind of testing in a fast, reliable and accurate way.

With the valuable support of some of our partner companies, we have been the first firm to study, design and supply to the market special-shape flat jacks to be used in combination with a ring cutter with a unique eccentric rim drive system.

From flat jacks to the hydraulic pump, from strain gauge to cutter, from measuring liquid to data processing software, not to mention both at office and on-site training, we can offer the widest product range, support and expertise available in the market.

MODELS

FLAT JACKS MODEL MP-A:

Mainly used for the measurement of low stress values in the masonry, these flat jacks, available in either rectangular and semioval shapes, have an overall thickness of 4 mm and are made out of 0.8 mm steel sheets, according to RILEM recommendation (MDT.D. 4). The low stiffness of the sheets and the special welding-method of the edges give these jacks a high sensitivity to low pressures.
The flat-jack constant Km results between 0.80 and 0.90 even at pressure values as low as 0.5 bar, making this jack particularly fit to single-jack testing method on masonry with limited loads.

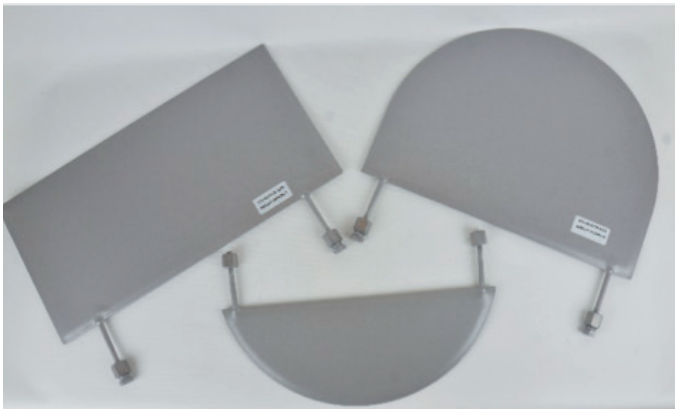


Figure 3 - Models of flat jacks.

Custom made MP-A flat jacks have been supplied for special applications; among other versions with 0.5 mm sheet metal and special welding for use in the field up to pressures of 250 bar and guaranteed breaking at 400 bar while maintaining the same deformability qualities.

FLAT JACKS MODEL GL-A:

Made with thicker sheet metal for application in structures with medium-high loads, they are also to be preferred in cases where the jack must be reused several times or in disposable applications: in this second case the jack, cemented in the cut , will be used to monitor the variations in the stress state at that point.

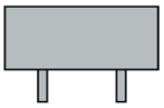
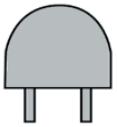
SEDE CASORIA (NA)
Via G. Puccini, 12/A
80026 - Casoria (NA)
Tel.:(+39)081.758.35.66
Fax.:(+39)081.758.78.57
info@boviar.com

SEDE GERENZANO (VA)
Via G. Falcone, 41
21040 - Gerenzano (VA)
Tel.:(+39) 02.937.99.240
Fax.:(+39) 02.933.01.029
info@boviar.com

BOVIAR

Although stiffer than the MP-A model, these jacks are subjected to fatigue cycles under pressure (at low loads) to optimize their behavior when put under pressure.
On request, flat jacks can be made for special executions with various dimensions, shapes and thicknesses with a maximum pressure of up to 400 bar.

MECHANICAL CHARACTERISTICS

		RECTANGULAR	SEMICIRCULAR	SPECIAL FORMAT FOR CUT-OFF MACHINE
FORMAT				
DIMENSIONS	MP-A	400x200x4 mm 240x120x4 mm 400x120x4 mm	325x120x4 mm	350x260x4 mm
	GL-A	400x200x4 mm 240x120x4 mm 400x120x4 mm	325x120x4 mm	350x260x3,5 mm
MAXIMUM WORKING PRESSURE	MP-A	60 bar	60 bar	60 bar
	GL-A	100 bar	100 bar	100 bar

JACK CALIBRATION

A flat jack has an inherent stiffness which resists expansion when the jack is pressurized due to the resistance to flexing of the metal, particularly at the edges and to diaphragm action (tension) in the steel sheet as it is expanded. Therefore, the fluid pressure in the flat jack is greater than the stress the flat jack applies to masonry. A flat jack must be calibrated to provide a conversion factor to relate internal fluid pressure to stress applied.
The flat-jack coefficient Km is the main correction factor used when calculating the relation between applied pressure and the actual stress transmitted to the structural element.

Figure 4 - Calibration of a flat jack.

Therefore the more accurate the Km coefficient is, the nearer to the actual value the computed stress will result.

The definition of a Km coefficient of a flat jack is obtained from experimental calibration procedures in a material testing laboratory. The calibration of our high-deformability flat jacks and the consequent determination of the Km coefficient is made by the Laboratory of Department of Engineering at the University of Genova. Flat jacks, each identified by a serial no. of its own, are calibrated either per manufacturing lot or individually, when requested.
The calibration of the GL-A model takes place directly in the factory by the German manufacturer Glotzl and a document with the km factor is issued for each jack equipped with a serial number.

SEDE CASORIA (NA)
Via G. Puccini, 12/A
80026 - Casoria (NA)
Tel.:(+39)081.758.35.66
Fax.:(+39)081.758.78.57
info@boviar.com

SEDE GERENZANO (VA)
Via G. Falcone, 41
21040 - Gerenzano (VA)
Tel.:(+39) 02.937.99.240
Fax.:(+39) 02.933.01.029
info@boviar.com

BOVIAR

CUTTING EQUIPMENT

Different cutting equipment can be used to make the slots where flat jacks are to be placed. It is important that the size and thickness of the slots are as nearer as possible to the dimensions of the flat jack being used. For our large semioval flat jacks we suggest the use of a special cutter with an eccentric rim drive system which gives very good performances in all type of construction materials. The ring blade used by such a cutter allows to obtain rather quickly semi-circular cuts as deep as 260 mm in which the mentioned jacks are ideally placed.

Figure 5 - Motor-cutter with eccentric traction.

DEFORMATION MEASUREMENTS

The choice of an accurate instrument is essential to get reliable results from flat-jack testing.
The original Demec strain gauge that we propose is a removable instrument with a resolution of 0,002 mm (analogic version) or 0,001mm (digital version) and an excellent measurement repeatability.
The strain gauge (usually with 200 mm gauge length, other lengths available on request) is used in flat-jack testing for displacement measurements across (or between) the cuts in which the jacks are inserted.
It consists of an invar beam with two conical locating points mounted at both ends.
One of the heads is fixed, while the other is free to pivot on a special knife.
The conical points of the instrument are placed in the small holes of special stainless steel discs applied in advance to the structure surface by using a proper adhesive and a setting out bar, which is part of the standard supply. The readings measured on the dial gauge refer to the movement of the pivoting head due to any movement of the discs caused by strain and is compared to the initial zero values.
The accuracy is 0.002 mm.
In the digital version, Boviar offers two products: the first mounts a digital comparator with 0.001 mm resolution, equipped with a zeroing device for statistical data management, while the second instrument is of national production with a different measurement system.

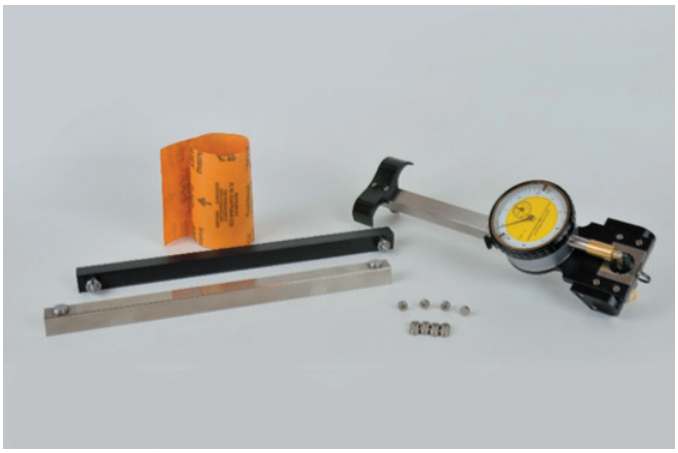


Figure 6 - DEMEC deformometer.

Figure 7 - Application of the DEMEC deformometer.

SEDE CASORIA (NA)

Via G. Puccini, 12/A
80026 - Casoria (NA)
Tel.:(+39)081.758.35.66
Fax.:(+39)081.758.78.57
info@boviar.com

SEDE GERENZANO (VA)

Via G. Falcone, 41
21040 - Gerenzano (VA)
Tel.:(+39) 02.937.99.240
Fax.:(+39) 02.933.01.029
info@boviar.com

BOVIAR

MANUAL HYDRAULIC PUMP

GLÖTZL PUMP MODEL M2H16

For loading the jacks and for reading them, a hydraulic hand pump is available, which Boviar commissioned from the German company Glötzl specifically for flat jacks.
Even today this pump is considered by insiders to be the state of the art of hydraulic systems for placing the jacks in charge.
The Glötzl model M2H16 has two class 1 precision pressure gauges (standard range: 0-25 bar and 0-100 bar).

It is equipped with an exchange circuit so as to be able to use the most suitable measuring range for the test to be performed with maximum reading resolution. The heart of the instrument is the pumping device which ensures excellent control over the readings made by keeping the pressure constant for each increment. The model for flat jacks has a larger tank and allows the recovery of the measurement fluid which, once the test is finished, is made to flow back into the aforementioned tank. The use of a very fluid (but not foamy) mixture as the measuring liquid allows disturbance factors such as pressure drops to be considerably reduced. Supplied in an aluminum container with accessories for filling the tank and connection to the jacks with a 1.5 liter package of measuring mixture. Pressure gauges are available on request from 0.6 to 600 bar.

Figure 8 - M2H16 pump precision gauges.

Figure 9 - Hand lever hydraulic pump with digital pressure gauge.

HAND LEVER HYDRAULIC PUMP WITH DIGITAL PRESSURE GAUGE

Pump connected to the jack via high pressure (700 bar) hydraulic hose (2.5 m long).
Digital pressure gauge with full scale 250 bar with peak index and “ACCREDIA” calibration certificate.

ACCESSORIES AND KITS

Optional products:

- Hydraulic pump and fittings;
- Digital pressure gauge for hydraulic pump;
- Motor-cutter with eccentric traction;
- DEMEC deformometer.

APPLICATIONS

- Building diagnostics

WARRANTY

12 months.

UPDATES

- Last updated tab: 2022.06;
- Specifications and standards subject to change without notice;
- Check the site updates for the cards, projects, and other photos of the product **www.boviar.com**

SEDE CASORIA (NA)
Via G. Puccini, 12/A
80026 - Casoria (NA)
Tel.:(+39)081.758.35.66
Fax.:(+39)081.758.78.57
info@boviar.com

SEDE GERENZANO (VA)
Via G. Falcone, 41
21040 - Gerenzano (VA)
Tel.:(+39) 02.937.99.240
Fax.:(+39) 02.933.01.029
info@boviar.com

BOVIAR